DOCUMENT RESUME

ED 152 543 SE 024 060

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TITLE Iowa Commercial Pesticide Applicator Manual, Category 1A: Agricultural Weed Control.
INSTITUTION Iowa State Univ. of Science and Technology, Ames. Cooperative Extension Service.
REPORT NO CS-9
PUB DATE Mar 76
NOTE 63p.; For related documents, see SE 023 740 and SE 024 061

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Agriculture; *Certification; *Environment; *Field Crops; *Herbicides; Pesticides; Plant Growth; *Plant Identification; Weeds

ABSTRACT

This manual provides information needed to meet the standards for pesticide applicator certification. Weeds, their effects, and control in relation to crop production are presented. Pre- and post-emergence treatments are discussed for row crops such as corn and soybeans. Problems with herbicide application to grass pastures, small grains, and legume forages are discussed. Special considerations like re-entry intervals, phytotoxicity, residues and environmental contamination are highlighted. (CS)

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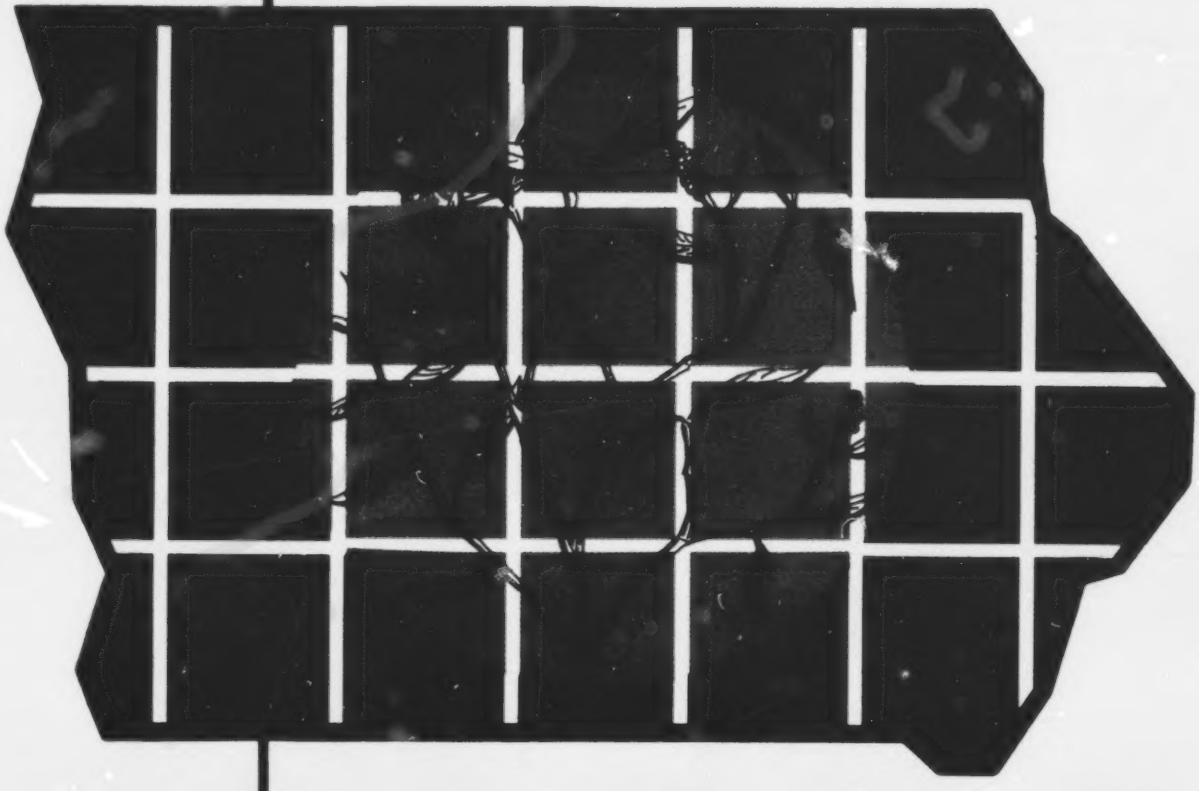
Iowa
Commercial Pesticide Applicator Manual

CATEGORY 1A

AGRICULTURAL WEED CONTROL



This manual is to be used for certification training in conjunction with the U. S. Department of Agriculture – U. S. Environmental Protection Agency manual, **Apply Pesticides Correctly,** EPA-335.

Cooperative Extension Service
IOWA STATE UNIVERSITY
Ames, Iowa 50011

CS-9
March 1976

This manual has been developed for individuals wishing to become certified in commercial pesticide applicator category 1A, Agricultural Weed Control. It contains specific information that an individual must know before becoming certified in category 1A. The manual has been designed to supplement the general information contained in the core manual, **Apply Pesticides Correctly—A guide for commercial applicators** (plus an Iowa State University supplement) and should not be used for certification preparation without referring to the core manual as well.

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Prepared by Vivan M. Jennings, extension weed specialist, and Stephen O. Ryan, pesticide training coordinator, who express appreciation to the University of Georgia for the use of source material.

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October 20, 1976

Commercial Applicators:

Recent production and marketing changes involving herbicides require the need for this additional information for your category manual. Please attach this information to Category Manual 1-A, Agricultural Weed Control.

CORN HERBICIDES

Pages 11, 12, 13: Atrazine 4L will be available in 1977 along with Atrazine 80W and Atrazine under the trade name of AAtrex 80W and 4L.

Pages 11, 12: Bladex 4WDS will be Bladex 4L in 1977. The 4L formulation is now cleared with Sutan + along with the 80W formulation.

Pages 13, 14: Propachlor will be marketed in 1977 as Ramrod 65W, Ramrod 20G, Bexton 20G, Propachlor 65W and Propachlor 20G. Also in combination with Atrazine or Ramrod + Atrazine 69W, Propachlor/Atrazine 69W and AAtram 20G.

Page 15: Roundup may be used to control many perennial weeds in corn, soybeans, small grain and noncropland areas.

Page 15: Banvel + 2,4-D may be used to control hemp dogbane in corn after the first week in September.

SOYBEAN HERBICIDES

Page 19: Additional preplant incorporated soybean herbicides for 1977 include Amex, Basalin and Prowl. All should be incorporated similar to Treflan.

Pages 19, 20: Cobex is now registered with Sencor as a tank mix and an overlay treatment.

CS-9A
File: Ag. Chem. 2

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SOYBEAN HERBICIDES (cont.)

Pages 20, 21: Lasso + Amiben is now registered as a preemergence tank mix.

Page 20: Dyanap is now registered as a postemergence treatment in soybeans.

SMALL GRAINS HERBICIDES

Page 34: In the right-hand column, delete the following sentences: Two, 4-DB (Butoxone or Butyrac) can be employed; legumes are reasonably resistant to this herbicide.

and

If 2,4-DB is used, grain or forage must not be harvested at least 30 days following treatment.

Jerald R. DeWitt

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JRD:jm

CROP PRODUCTION

Modern, efficient agriculture produces crops on large, continuous acreages of land. Unfortunately, this type of agriculture encourages invasion of the crops by a wide variety of damaging pests. Therefore, production of these crops also requires the use of large quantities of pesticides to produce the quantity and quality of products needed by man. The productivity of modern agriculture is probably the most important underlying factor that gives the United States the highest standard of living in the world.

Agricultural crops may be divided into field and forage crops, vegetable crops and orchard crops. The need for pesticides for maximum production of high quality products has been documented many times by research and experience. The quality of products grown without the use of pesticides is generally much lower, and, in many instances, too low to be accepted for market.

Proper care must be exercised in applying pesticides to any crop. Methods of application vary widely with some being more dangerous to the applicator than others. For example, spraying orchard trees where the pesticide is applied above the head of the applicator is much more hazardous than applying chemicals to a low growing field or forage crop.

When planting crops, consideration should be given to the pesticides used during the production season, the methods of application employed and whether either the pesticides or application methods present any problem for adjacent non-target areas such as bodies of water, woodlands, urban areas and other crops. Every effort should be made in planning to prevent or minimize any such problems.

Changes in registrations of old pesticide products or new product registrations may occur before each cropping season. Carefully read the label before using any pesticide.

WEED CONTROL IN ROW CROPS

Most Iowa farmers use a combination of cultural and chemical methods to effectively control weeds in corn and soybeans.

Primary tillage practices may include moldboard plowing or some form of reduced tillage that will adequately allow preparation of a desirable seedbed in the row.

A conventional tillage program usually involves moldboard plowing followed by a disk or field cultivator in early spring to destroy early germinating weeds. Preplant chemical treatments are often applied at this time. This should be followed 7 to 10 days later by disking or field cultivating in the opposite direction to more adequately mix preplant treatment. A harrow or leveling device on the disk may be useful. Disking usually provides better mixing of preplant chemicals than a field cultivator. Set the disk to run approximately 5 inches deep and operate at 6 miles per hour for most effective results. Plant as soon as possible after final disking.

A reduced-tillage program may employ any of the following as a form of primary tillage, or in many cases, final tillage before planting:

—A heavy disk may be used in soybean stubble going to corn at which time preplant herbicide treatment may be applied followed by cross disking up to 7 to 10 days later at a shallower depth for best weed control. An initial, deep disking may be necessary in corn stubble before application of preplant herbicide treatments. Adequate stands may be more difficult to obtain where last year's corn stubble is being prepared for corn, and particularly soybeans the following year.

—A chisel plow may be used for primary tillage with nitrogen fertilizer applied at the same time. This practice is most advantageous in the fall on heavier soils. It may also result in less wind erosion potential than moldboard plowing. Fall chiseling may be treated in the spring similarly to moldboard plowing before planting with preplant herbicide treatments.

—Rotary tillage is usually performed at final seedbed preparation. The previous years' residue should be disked 7 to 10 days prior to planting with a rototiller equipped with unit planters. Preplant herbicide treatments applied by rototilling are usually adequately mixed with the soil. Application should be directly ahead of the rotors. Rotors should not till deeper than 2 inches. The seed should be placed and firmed into the untilled soil beneath the tilled soil for acceptable stands.

Till planting and no-till planting do not allow the use of preplant incorporated herbicides, since no primary tillage is done before planting.

Most preemergence herbicide treatments will work effectively where the above tillage practices have been used. Preemergence treatments should be applied as soon after planting as possible to be most effective. Unless the chemical may be used postemergence as well as preemergence, care should be taken if a form of reduced tillage is used where weeds have already emerged. In this situation, a "burn-down" chemical, a selective postemergence chemical or cultural method of controlling these particular species is needed. Be

cautious of excessive residue that may not allow adequate distribution of the preemergence herbicide. Weeds may be very difficult to manage in reduced tillage programs if not adequately controlled each year.

If rainfall is not adequate to activate preemergence herbicides, rotary hoeing may increase the herbicide effectiveness. A good rule of thumb is to rotary hoe if you see weeds emerge even if you have used a preemergence herbicide.

After the crop has emerged and when weeds are at or near emergence, rotary hoeing can greatly reduce weed populations. A harrow may also be used on corn at this time. Row cultivation is also effective when weeds are small, but the crop needs to be tall enough for acceptable weed control. Don't cultivate too deep because shallow root systems may be damaged. A rolling cultivator, if properly set, will provide excellent early weed control and allow faster cultivating speeds than conventional cultivators.

Forms of reduced tillage may not allow the use of a rotary hoe or conventional cultivator. Special cultivators are needed for till-planted crops and no cultivation equipment may be acceptable if no-till has been used in a sodded seedbed condition. However, it is usually not needed.

Most postemergence herbicides should be applied when weeds are small and actively growing to be effective. A cultivation after a postemergence herbicide treatment usually provides more complete weed control. In the following tables, rates are given as broadcast rates of commercial product per acre. For band applications, adjust rates for band width.

Many interacting factors govern the effectiveness of herbicides and the potential for crop injury. Included are environmental conditions such as rainfall, temperature and relative humidity and managerial factors such as depth of planting, time of planting, time of application, general tillage practices in seedbed preparation, weed species present in the field, rate and kind of chemicals needed to provide greatest economic return from the crop.

Information in this manual summarizes research on the effectiveness of various methods of cultural and chemical weed control. Data provided is from research conducted by the Iowa Agricultural Experiment Station, research demonstration plots throughout Iowa evaluated by area crop production specialists and county extension directors, plus other sources.

MAJOR WEEDS IN ROW CROPS

(see illustrations and information on following pages)

Common Name	Scientific Name	Other Common Names
BROADLEAF WEEDS		
Bindweed	*Convolvulus* spp.	Field and hedge bindweed, creeping jenny, pea vine
Black nightshade	*Solanum nigrum*	
Cocklebur	*Xanthium stumarium*	
Common milkweed	*Asclepias syriaca*	
Giant ragweed	*Ambrosia trifida*	Horseweed
Common smartweed	*Polygonum persicaria*	Ladysthumb
Common ragweed	*Ambrosia artemisiifolia*	Ragweed, small ragweed
Hemp dogbane	*Apocynum cannabinum*	Indian hemp, dogbane
Jersualem artichoke	*Helianthus tuberosus*	
Jimsonweed	*Datura stramonium*	
Lambsquarters	*Chenopodium album*	
Morning glory	*Ipomoea* spp.	Includes tall or annual and ivy leaved
Pennsylvania smartweed	*Polygonum pensylvanicum*	
Pigweed	*Amaranthus* spp.	Redroot pigweed, rough pigweed, also smooth pigweed and hybrids
Sunflower (annual)	*Helianthus annuus*	
Velvetleaf	*Abutilon theophrasti*	Buttonweed, butter print
Venice mallow	*Hibiscus trionium*	Shoofly, flower-of-an-hour
GRASSY WEEDS AND SEDGES		
Barnyard grass	*Echinochloa crusgalli*	
Fall panicum	*Panicum dichotomiflorum*	Panicgrass
Giant foxtail	*Setaria faberii*	
Green foxtail	*Setaria viridis*	Includes many hybrids, robust white and purple
Large crabgrass	*Digitaria sanguinalis*	
Quackgrass	*Agropyron repens*	
Wirestem muhly	*Muhlenbergia frondosa*	
Witchgrass	*Panicum capillare*	
Woolly cupgrass	*Eriochloa villosa*	
Yellow foxtail	*Setaria lutescens*	Pigeon grass

MAJOR WEEDS IN ROW CROPS

BROADLEAF WEEDS

FIELD BINDWEED, Creeping jenny, Small morning glory *(Convolvulus arvensis).* **1**, plant in flower; **2**, seed pod, entire and in cross section; **3**, seed; **4**, variations in leaf shape. **Perennial**, reproducing by seeds and rootstocks.

HEDGE BINDWEED *(Convolvulus sepium).* **1**, plant in flower; **2**, seed; **3**, seed pod; **4**, variations in leaf shape. **Perennial**, reproducing by seed and fleshy creeping rootstocks.

BLACK NIGHTSHADE *(Solanum nigrum).* **1**, entire plant; **2**, berry; **3**, flower. **Annual**, reproducing by seed.

COCKLEBUR, Clotbur *(Xanthium pennsylvanicum).* **1**, upper part of plant; **2**, seed; **3**, bur; **4**, seedling plant. **Annual**, reproducing by seed.

COMMON MILKWEED *(Asclepias syriaca)*. **1**, lower part of stem and rootstock; **2**, upper part of stem with flower clusters and seed pods. **Perennial**, reproducing by seed and from long spreading rootstocks.

GIANT RAGWEED, Horseweed, Kinghead *(Ambrosia trifida)*. **1**, portion of stem showing leaves and flowers; **2**, seed. **Annual**, reproducing by seed.

LADYSTHUMB, Common Smartweed *(Polygonum persicaria)*. **1**, upper part of plant; **2**, section of stem, leaf, and leaf sheath; **3**, seed. **Annual**, reproducing by seeds.

COMMON RAGWEED *(Ambrosia artemisiifolia)*. **1**, plant; **2**, seed.

HEMP DOGBANE *(Apocynum cannabinum)* **1,** section of stems and rootstock; **2,** upper part of stem with leaves and flowers. **Perennial,** reproducing by seed and long, horizontal rootstocks.

JERUSALEM ARTICHOKE *(Helianthus tuberosus).* **1,** lower part of stem with roots, rootstocks, and immature tubers; **2,** section from middle of stem; **3,** upper portion of stem with flower heads. **Perennial,** reproducing by rhizomes, tubers, and seeds.

JIMSON WEED *(Datura stramonium).* Upper portion of plant. **Annual,** reproducing by seed.

LAMBSQUARTER *(Chenopodium album).* Roots, leaves and flowers. **Annual,** reproducing by seeds.

IVY-LEAVED MORNING GLORY *(Ipomoea hederacea).* **1,** Portion of plant. **Annual,** reproducing by seed.
ANNUAL MORNING GLORY *(Ipomoea purpurea)* **2,** leaf.

PENNSYLVANIA SMARTWEED *(Polygonum pensylvanicum).* **1,** lower part of plant; **2,** upper part of plant. **Annual,** reproducing by seeds.

ROUGH PIGWEED, Redroot *(Amaranthus retroflexus).* **1,** lower stem and roots; **2,** upper stem with leaves and flower clusters. **Annual,** reproducing by seeds.

SUNFLOWER *(Helianthus annuus).* **1,** upper stem with flowers; **2,** lower stem and root system. **Annual,** reproducing only by seed.

VELVET LEAF, Indian mallow, Butter print *(Abutilon theophrasti).* **1,** root; **2,** upper part of stem with flowers. **Annual.**

VENICE MALLOW, Flower-of-an-hour *(Hibiscus trionum).* Entire plant. **Annual,** reproducing by seed.

GRASSY WEEDS

BARNYARD GRASS *(Echinochloa crusgalli).* Plant. **Annual** with fibrous, rather shallow roots.

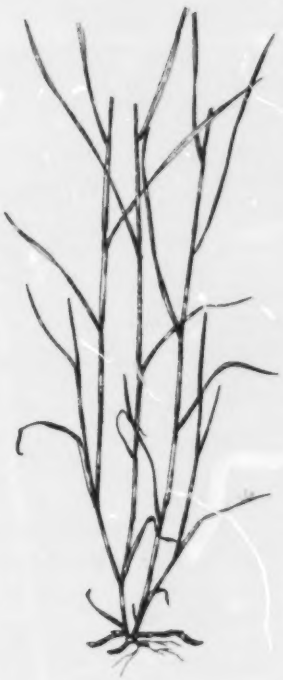
FALL PANICUM, Spreading panicgrass *(Panicum dichotomiflorum).* **1,** lower part of plant showing root system; **2,** panicle. **Annual** with fibrous roots, reproducing by seeds.

GIANT FOXTAIL *(setaria faberii).* **1,** lower part of plant; **2,** stem with panicle. **Annual,** reproducing by seed.

GREEN FOXTAIL, Green bristlegrass *(Setaria viridis).* Entire plant. **Annual,** similar to giant foxtail but smaller, growing 1 to 3 feet tall.

LARGE CRABGRASS, Large hairy crabgrass *(Digitaria sanguinalis).* Entire plant. **Annual,** reproducing by seed.

QUACKGRASS, Couchgrass *(Agropyron repens).* Stems, leaves, and inflorescence. **Perennial,** reproducing by seed and underground rootstocks.



WIRESTEM MUHLY *(Muhlenbergia frondosa)*. Lower part of plant. **Perennial,** reproducing by seeds, rootstock (rhizome) growth, and rootstock fragments.

WITCHGRASS, Tumble panicgrass *(Panicum capillare)*. Entire plant. **Annual** with fibrous roots, reproducing by seeds.

WOOLLY CUPGRASS. *(Eriochloa villosa)* Lower and upper part of plant. **Annual,** reproducing by seeds.

YELLOW FOXTAIL, Pigeon grass *(Setaria lutescens)*. Entire plant. **Annual,** reproducing by seeds.

CORN HERBICIDES

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
Preplant incorporated treatments—to be applied prior to planting the crop and incorporated into the soil			
Germinating annual grasses and broadleaf weeds (see effectiveness ratings)	AAtrex 80W or 4L Atrazine 80W	For use on field corn, sweet corn, silage corn, popcorn and seed production fields. Atrazine may cause injury to succeeding crops. Carryover is usually greater on calcareous soils.	Do not graze or feed forage for 21 days after treatment.
also shattercane and yellow nutsedge	Sutan + (butylate plus safening additive) Available as 6E or 6.7E Sutan available as 10G	Incorporate immediately with a disk. Set at 4- to 6-inch depth and operate at 4 to 8 mph followed by a leveling device or spiketooth harrow. Safening additive reduces risk of corn injury.	None
also shattercane and yellow nutsedge	Sutan + AAtrex or Atrazine (butylate plus atrazine). Use Sutan 6E or 6.7E plus 80W tank mix	Incorporate immediately with a disk. See remarks under AAtrex and Sutan. Use higher rate of Sutan on soils above 5% organic matter or on heavy infestations of shattercane or yellow nutsedge.	Do not graze or feed forage for 21 days after treatment.
also shattercane and yellow nutsedge	Sutan + plus Bladex (butylate plus cyanazine) Sutan 6E or 6.7E plus Bladex 80W	Incorporate immediately with a disk. May plant any crop the following year. Do not use on sands, loamy sands, or soils less than 1% organic matter. See remarks under Sutan.	None
also shattercane and yellow nutsedge	Eradicane (EPTC plus safening additive 6.7E)	Do not use on seed crop. Incorporate immediately.	None
also yellow nutsedge	Lasso (alachlor) 4E or 15G	Preemergence treatments are better for annual grass control.	None
	Lasso plus AAtrex or Atrazine (alachlor plus atrazine) 4E + 80W or AAtrex 4L	Apply within 7 days of planting and incorporate no more than necessary for maximum Lasso activity. See remarks under AAtrex.	Do not graze or feed forage for 21 days after treatment.
Preplant incorporated + early postemergence treatments			
Germinating annual grasses and broadleaf weeds			
also quackgrass, wirestem muhly	AAtrex (atrazine) 80W or 4L	Apply 2½ lb of 80W or 2 qt 4L in fall or spring and plow one to three weeks later. Apply a second equivalent application in spring before, during, or after planting but before annual weeds and grasses are 1½ inches high. Follow only with corn the next year.	Do not graze or feed forage for 21 days after treatment.

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
also Canada thistle Jerusalem artichoke	AAtrex (atrazine) 80W or 4L	Apply during or shortly after planting corn 2½ lb of 80W or 2 qt of 4L before corn and weed emergence followed by a second equivalent treatment with 1 gal crop oil after crop and weed emergence, but before weeds are 6 inches tall. A supplementary application of 2,4-D amine + Banvel in the 2- to 5- leaf stage of corn may provide better control of Jerusalem artichoke. Follow only with corn the next year. Several annual treatments may be required for complete control of these weeds.	Do not graze or feed forage for 21 days after treatment.
Preemergence treatments — Applied from planting time to crop or weed emergence.			
Germinating annual grasses and broadleaf weeds (see effectiveness ratings)	AAtrex 80W or 4L Atrazine 80W	See preplant remarks and use accordingly.	Do not graze or feed forage for 21 days after treatment.
	Bladex (cyanazine) 80W, 4WDS and 15 G	DO NOT use on soils less than 1% organic matter or on sands or loamy sand soils. Very responsive to organic matter and soil texture— may cause injury if rates are exceeded for soil type and organic matter and under extreme environmental conditions. Do not use on peat or muck soils.	None
Germinating annual grasses and broadleaf weeds (see effectiveness ratings)			
mostly annual grasses	Lasso [alachlor 4E or 15G (Lasso II)]	Use on field corn, seed corn, silage corn and sweet corn. Do not use with liquid fertilizer on sweet corn. Lasso II is not cleared on sweet corn.	Do not graze or feed forage for 21 days after treatment.
	Lasso plus AAtrex or Atrazine (alachlor plus atrazine) 4E plus 80W or AAtrex 4L	If activated by sufficient rainfall, this combination provides excellent annual grass and broadleaf weed control.	Do not graze or feed forage for 21 days after treatment.
	Lasso plus Bladex (alachlor plus cyanazine) 4E plus 80W	DO NOT use on sands or loamy sands or soils with less than 1% organic matter. Velvetleaf not often controlled. Field corn and silage corn only.	Do not graze or feed forage for 21 days after treatment.
	Lasso plus Banvel (alachlor plus dicamba) 4E plus 4E	Banvel increases broadleaf weed control and is useful on variable soils, since it is not greatly af-	Do not graze or harvest for feed before milk stage.

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
		fected by organic matter. Banvel should be used only on soils above 2½% organic matter and of a silty clay loam or clay texture. Crop injury may occur on sandy soils following heavy precipitation. Field corn only.	
	Lorox plus Lasso (linuron plus alachlor) 50W plus 4E	Plant corn no less than 1¾ inches deep. DO NOT use on sands, loamy sands or soils with less than 1% organic matter. On soils above 4%, broadleaf control with Lorox will be reduced.	Do not graze or harvest immature corn for feed within 12 days of treatment.
Germinating annual grasses and broadleaf weeds (see effectiveness ratings)			
mostly annual grasses	Ramrod (propachlor) 65W or 20G or Bexton 20G	Use on field corn, silage corn, sweet corn, and seed fields. Best used on soils above 3% organic matter. May cause irritation to applicator.	None
	Ramrod plus AAtrex or Atrazine (propachlor plus atrazine) 65W plus 80W and 69%W. AAtram 20G is a granular formulation of Propachlor + atrazine.	Use on field corn, silage corn, sweet corn and seed fields. See comments under AAtrex and Ramrod.	Do not graze or feed forage for 21 days after treatment.
	Prowl (Penoxalin) 4E plus Atrazine 80W or Bladex 80W (cyanazine)	Do not use on sands or loamy sands or soils with less than 1½% organic matter. Do not use on peat or muck soils. Use higher rates with heavy weed populations and on above 3% organic matter soils.	Do not graze or cut for forage for 21 days after treatment.
Postemergence Treatments— To be applied after emergence of weed or crop			
Emerged broadleaf weeds and some grasses			
also yellow nutsedge	AAtrex 80W or 4L Atrazine 80W	Apply before weeds are 1½ inches tall. Adding 1 gal/A of crop oil increases control of grassy	Do not graze or feed forage for 21 days after treatment

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
		weeds. Use 1½ lb AAtrex or Atrazine 80W or 1.2 qt AAtrex 4L for annual broadleaf weeds only. Injury may occur if cold, wet conditions follow application of Atrazine in oil. DO NOT add 2,4-D.	
	Bladex (cyanazine) 80W	If 2½ lb/A exceeds recommended preemergence rate for your soil type, use the lower preemergence rate for postemergence application. DO NOT apply on sands or loamy sand soil types or on soils with less than 1% organic matter. Weeds should be no more than 1 to 1½ inches high and corn must not exceed the 4-leaf stage. Do not use Bladex as a postemergence treatment with nitrogen solutions. See remarks in Preemergence section.	None
	Lasso plus AAtrex or Atrazine (alachlor plus atrazine) 4E plus 80W	May be applied until corn is 5 inches tall but is less effective if weeds have gone beyond the 2-leaf stage.	Do not graze or feed forage for 21 days after treatment
Emerged broadleaf weeds and some grasses:			
	Ramrod plus Atrazine 65W plus 80W	May be applied until corn is 5 inches tall but is less effective if weeds have gone beyond the 2-leaf stage.	Do not graze or feed forage for 21 days after treatment
Emerged broadleaf weeds:			
	2,4-D Amine 4 lb a.e. 2,4-D ester low volatile 4 and 6 lb a.e.	Apply at the 2- to 5-leaf stage and not after. Corn is most susceptible to injury from 2,4-D when growing rapidly. After the 5-leaf stage, use as rescue ONLY with drop nozzles.	None
	2,4-D Amine plus Banvel (2,4-D plus dicamba) 4 lb a.e. plus 4 EC	Apply at the 2- to 5-leaf stage of corn and not after. Addition of Banvel provides better control of smartweed. **Precaution** should be taken to follow the Banvel label to avoid injury to nearby soybeans. This combination SHOULD NOT BE APPLIED BEYOND JUNE 20.	Do not graze or harvest for feed before milk stage.

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
Spring-applied emergency treatments— may cause crop injury			
Hemp dogbane	2,4-D amine 4 lb. a.e.	SPRING: Apply with drops 1 pt of 2,4-D in corn and 2 pt elsewhere in the spring bud stage. FALL: Apply 2 to 3 pt in corn with a surfactant in September on actively growing plants. Retreatment will be necessary.	None
Field bindweed Hedge bindweed	2,4-D amine 4 lb a.e.	SPRING: Apply with drops when leaves of plants are fully expanded. Retreatment will be necessary	None
Jerusalem artichoke	2,4-D amine 4 lb a.e.	SPRING: Apply 1 pt with drops in corn or ½ pt with drops following a ½-pt application in the 2- to 5- leaf stage of corn on plants with fully expanded leaves. Retreatment will be necessary.	
Common milkweed		No control in row crops.	
Late summer treatments to affect weed seed viability			
Cocklebur seed Sunflower seed Velvetleaf seed	2,4-D	Apply at least after corn silks have turned brown. Preferably after soft dough stage for maximum crop safety. Will reduce viability of weed seed if applied to weeds with immature green seeds. A surfactant may be beneficial.	
No-till and reduced tillage weed control in corn— to be applied on emerged weeds but prior to crop emergence			
Burndown of existing vegetation plus germinating broadleaf and grassy weeds	AAtrex or Atrazine 80W plus Paraquat 2CL plus nonionic spreader	Add AAtrex or Atrazine and mix followed by Paraquat. DO NOT use with suspension or high phosphate liquid fertilizers as carriers. Observe precautionary safety statements on the Paraquat label before using. Use 20 to 60 gal of spray solution per acre. Higher gallonage provides better coverage and control.	Do not graze or feed forage from treated area within 21 days after treatment.
	Bladex (cyanazine) 80W plus Paraquat 2CL plus nonionic spreader	Add Bladex and mix followed by Paraquat. See precautionary statements under Bladex pre-	None

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
		emergence. DO NOT use with liquid fertilizer. Observe precautionary safety statements on the Paraquat label before using. Use 20 to 60 gal of water per acre. Higher gallonage provides better coverage and control.	
Burndown of existing vegetation plus germinating broadleaf and some grassy weeds	Lasso (alachlor 4E) Plus AAtrex or Atrazine 80W Plus Paraquat 2CL Plus nonionic spreader	Add AAtrex or Atrazine, mix, add Lasso and Paraquat and mix thoroughly. DO NOT use with suspension or high phosphate liquid fertilizers as carriers. Observe precautionary safety statements on the Paraquat label before using. Use 20 to 60 gal of spray solution per acre. Higher gallonage provides better coverage and control.	Do not graze or feed forage from treated area within 21 days after treatment.

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CORN HERBICIDES

This material is included for your information only; it is not required for certification.

Weed Response to Selected Corn Herbicides

E = Excellent G = Good F = Fair P = Poor

Preplant	Crop Tolerance	Barnyard Grass	Crabgrass	Fall Panicum and Witchgrass	Foxtail (spp.)	Woolly cupgrass	Shatter cane	Black Nightshade	Cocklebur	Jimsonweed	Lambsquarter	Annual morning glory	Mustard	Pigweed	Ragweed	Smartweed	Sunflower	Velvetleaf	Bindweed, Field & Hedge	Hemp dogbane	Milkweed	Quackgrass	Wirestem muhly	Yellow nutsedge	Jerusalem artichoke
	Grasses							**Broadleaves**											**Perennials**						
AAtrex or Atrazine	E	G	F	P	F	P	F	E	G-E	E	E	G	E	E	E	E	G	E	P	P	P	F	F	F	F
Sutan+	E	E	E	E	E	G	G	F	P	P	G	P	P	F	P	P	P	P	P	P	P	P	P	G	P
Sutan+ + AAtrex	E	E	E	E	E	G	G	E	F	G	E	F	E	E	E	E	F-G	G	P	P	P	P	P	G	P
Sutan+ + Bladex	G	E	E	E	E	G	G	E	F	F	E	F	G	G	E	E	F	F	P	P	P	P	P	G	P
Eradicane	E	E	E	E	E	E	E	E	P	P	G	G	P	G	F	P	P	F	P	P	P	G	G	G	P
Lasso	E	G-E	G-E	G-E	G-E	G	F	G	P	P	P	P	P	G	F	P	P	P	P	P	P	P	P	G	P
Split PPI + Early Post																									
AAtrex + AAtrex or Atrazine + Atrazine	E	G	F	P	G	P	F	E	E	E	E	E	E	E	E	E	E	E	F*	P	P	E*	G*	G*	G*
Preemergence																									
AAtrex or Atrazine	E	G	F	P	F-G	P	P	E	G	E	E	G	E	E	E	E	G-E	E	P	P	P	F	P	F	P
Bladex	G	G	G	G	G	P	P	G	G	G	G	F	G	F	G	E	F	G	P	P	P	P	P	F	P
Lasso	E	E	E	E	E	E	F	F	P	P	F	P	P	G	F	F	P	P	P	P	P	P	P	G	P
Lasso + AAtrex	E	E	E	G	E	E	F	E	G	G	E	F	E	E	E	E	G	E	P	P	P	P	P	F	P
Lasso + Bladex	E	E	E	E	E	E	F	E	F	F	E	F	E	E	E	E	F	G	P	P	P	P	P	F	P
Lasso + Banvel	F-G	E	E	G	E	E	F	G	F	F	G	P	G	E	E	E	F	F	P	P	P	P	P	F	P
Lorox + Lasso	F	E	E	G	E	E	F	G	F	F	E	F	E	E	E	G	F	F	P	P	P	P	P	F	P
Ramrod	E	E	E	G	E	G	F	G	P	P	G	P	P	F	P	P	P	P	P	P	P	P	P	F	P
Ramrod + Atrazine	E	E	G	G	E	G	F	E	F	F	E	F	G	G	G	E	G	G	P	P	P	P	P	F	P
Postemergence																									
AAtrex or Atrazine + crop oil	G	G	F	P	F-G	P	P	E	E	E	E	E	E	E	E	E	E	E	F	P	P	F	F	G	F*
Bladex	F	G	F	F	G	P	P	E	F	G	G	G	E	G	E	E	F	F	P	P	P	P	P	P	P
2,4-D (2- to 5-leaf stage of corn)	F	P	P	P	P	P	P	F	E	G	G	G	G	G	G	P	F	G	G*	P	P	P	P	P	F*
2,4-D + Banvel (2- to 5-leaf stage of corn)	F	P	P	P	P	P	P	G	E	G	G	G	G	G	G	E	G	G	G*	P	P	P	P	P	F*
Outfox	F	G	G	F	G	P	P	E	E	G	E	G	E	E	E	G	G	G	P	P	P	P	P	P	P
2,4-D with drops when weeds are a problem (EMERGENCY ONLY)	P	P	P	P	P	P	P	F	E	G	G	E	G	G	G	P	F	G	G*	F-G*	F*	P	P	P	G*

* Degree of perennial weed control is often a result of repeated application.

This chart should be used only as a guide. Ratings of chemicals may be higher or lower than indicated depending on soil characteristics, managerial factors, environmental variables and rates applied.

Phototoxicity Symptoms of Misapplied Corn Herbicides

Preplant:

AAtrex or Atrazine	none
Sutan +	none with safening additive
Sutan + + AAtrex	none with safening additive
Sutan + + Bladex	none with safening additive
Eradicane	none with safening additive
Lasso	none

Split PPI + Early Post

AAtrex + AAtrex or Atrazine + Atrazine	none

Preemergence:

AAtrex or Atrazine	none
Bladex	chlorosis
Lasso	twisting of plants (granules)
Lasso + AAtrex	none
Lasso + Bladex	chlorosis
Lasso + Banvel	twisting of plants, root inhibition
Lorox + Lasso	chlorosis
Ramrod	none
Ramrod + Atrazine	none
Prowl	twisting of plants, root inhibition
Prowl + Atrazine	twisting of plants, root inhibition
Prowl + Bladex	twisting of plants, root inhibition

Postemergence:

AAtrex or Atrazine + crop oil	chlorosis with low temperatures
Bladex	chlorosis and necrosis
2,4-D (2- to 5-leaf stage of corn)	leaf and root deformity
2,4-D + Banvel (2- to 5-leaf stage of corn)	leaf and root deformity
2,4-D with drops when weeds are a problem; EMERGENCY ONLY	plant deformity and stalk breakage

SOYBEAN HERBICIDES

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
Preplant incorporated treatments— to be applied prior to planting the crop incorporated into the soil.			
Germinating annual grassy weeds (see effectiveness ratings)	Treflan (trifluralin) 4E and 5G	May be applied up to 10 weeks before planting. Thorough incorporation by disking 4 to 6 inches deep is important. Incorporation should be as soon as possible after application but no longer than 8 hours. A second disking 7 to 10 days afterwards is desirable.	None
	Cobex (dinitramine) 2E	Apply Cobex during final seedbed preparation. Incorporate at a shallower depth than when applying Treflan for effective weed control and less crop injury problems. Incorporate within 24 hours. A field cultivator with a leveling device behind may also be used to incorporate Cobex.	None
	Tolban (profluralin) 4E	Apply and incorporate as with Treflan. One qt/A rate may not be as effective on higher organic matter soils. Incorporate within 4 hours after application.	None
(also yellow nutsedge)	Lasso (alachlor) 4E and 15G (Lasso II)	Preemergence treatments are better for annual grass control.	None
Germinating annual grasses and pigweed; velvetleaf at higher rates—also yellow nutsedge	Vernam (vernolate) 7E, 10G and 10GK	Must be incorporated into soil immediately. May be tank mixed with Treflan.	None
Germinating annual grasses and broadleaf weeds	Treflan (trifluralin) 4E + Sencor/Lexone (metribuzin) 50W	Apply up to 7 days before planting and incorporate thoroughly by disking 4 to 6 inches deep. Provides excellent broad-spectrum weed control. **WARNING:** If atrazine was used the previous year, injury could occur. DO NOT use on soils above pH of 7.4 and/or calcareous. DO NOT use on sandy loam soils or soils with less than 2% organic matter. Use only on soils uniform and not varying greatly in organic matter, pH and texture.	None

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
Preplant incorporated + overlay treatments—Preplant to be applied prior to planting the crop incorporated into the soil; Overlay to be applied after planting but before crop emergence			
Germinating grassy and broadleaf weeds (see effectiveness ratings)	Treflan (trifluralin) 4E PPI + Amiben (chloramben) 2L and 10G	Use proportionately less for band applications of overlay treatment. Shallow incorporation by rotary hoeing may aid Amiben.	None
	Treflan (trifluralin) 4E PPI + Lorox (linuron) 50W	Lorox is best adapted to silt loam soils with less than 4% organic matter. Rate must be adjusted to soil type to obtain acceptable control and to avoid crop injury. DO NOT use on sandy or sandy loam soils with less than 1% organic matter. Intense rainfall on rough seedbeds may result in crop injury.	None
	Treflan (trifluralin) 4E PPI + Sencor/Lexone (metribuzin) 50W	Provides excellent broad-spectrum weed control. **WARNING:** If atrazine was used the previous year, injury could occur. DO NOT use on soils above pH of 7.4 and/or calcareous. DO NOT use on sandy loam soils or soils with less than 2% organic matter. Intense rainfall on rough seedbeds may result in injury to crop.	
	Treflan (trifluralin) 4E + Furloe (chlorpropham) 4E and 10G	Furloe may also be used as a granular treatment.	None
Preemergence treatments—Applied from planting time to crop or weed emergence.			
Germinating annual grasses and some broadleaf weeds	Lasso (alachlor) 4E and 15G (Lasso II)	Vary rates with organic matter and soil texture.	None
Germinating annual broadleaf weeds and grasses	Amiben (chloramben) 2 lb/gal liquid and 10G	Apply as soon after planting as possible. If no rain 4 to 6 days after treatment, rotary hoe.	None
	Lasso plus Lorox (alachlor plus linuron) 4E and 50W	Best adapted to silt loam soils with less than 4% organic matter. Rate must be adjusted for soil type to obtain acceptable control and to avoid crop injury. Do not use on sandy or sandy loam soils with less than 1% organic matter. Intense rainfall on rough seedbeds may result in crop injury.	None

Weeds most effectively controlled	Herbicide and formulations available	Remarks	Limitations on crop use
	Lasso plus Sencor or Lexone (alachlor plus metribuzin) 4E and 50W	Provides excellent broad-spectrum weed control. **WARNING:** If atrazine was used the previous year, injury could occur. DO NOT use on soils above pH 7.4 and/or calcareous. DO NOT use on sands or loamy sands with less than 2% organic matter. Intense rainfall on rough seedbeds may result in crop injury.	None
	Lasso plus Maloran (alachlor plus chlorbromuron) 4E and 50W	DO NOT use on sandy or sandy loam soils with less than 1% organic matter. Best adapted to silt loam soils with less than 4% organic matter. Rates must be adjusted for soil types to obtain acceptable control and to avoid soybean injury.	Do not graze treated fields or feed treated forage to livestock.
	Lasso plus Furloe (alachlor plus chlorpropham) 4E and 4EC	Primarily for increasing smartweed control. Most often used with Lasso or as an overlay with Treflan. Furloe label guarantees smartweed control.	None
Germinating annual broadleaf weeds and grasses	Lasso plus Dyanap (alachlor plus dinoseb/naptalam)		
Postemergence treatments—To be applied after emergence of weed or crop.			
Most annual broadleaf weeds, including cocklebur, smartweed, velvetleaf, sunflower and jimsonweed. Nutsedge may be suppressed. Pigweed and lambsquarter are poorly controlled.	Basagran (bentazon) 4 lb per gal liquid	May be applied at first to third trifoliate leaf stage of soybean growth. Early application when weeds are small (2- to 4-leaf stage) provides best control. The larger the weeds, the higher the rate needed for acceptable control Complete spray coverage of leaf surface is essential. Adding a wetting agent improves control under stress conditions.	Do not apply within 65 days of harvest. Do not feed treated forage or hay to livestock.
Annual broadleaf weeds	Tenoran (chloroxuron)	Timely application is important in controlling susceptible broadleaf species. Some stunting of beans may occur.	Do not apply within 90 days of harvest, treated field should not be grazed.
Cocklebur	2,4-DB Butryac 200 or Butoxone SB	Effective primarily against heavy stands of cocklebur and should be considered only a rescue treatment. Apply as directed spray if soybeans are larger than cocklebur.	Do not harvest within 60 days after application.
Yellow nutsedge Canada thistle	Basagran 4 lb/gal	Apply 7 to 10 days after applied as above for annual broadleaf weed control.	Same as above.
Most other perennial weeds		No chemical control effective in soybeans.	

SOYBEAN HERBICIDES

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Weed Response to Selected Soybean Herbicides

E = Excellent G = Good F = Fair P = Poor

		Grasses						Broadleaves										Perennials						
PREPLANT:	Crop Tolerance	Barnyard Grass	Crabgrass	Fall Panicum	Foxtail (spp.)	Woolly cupgrass	Shatter cane	Black Nightshade	Cocklebur	Jimsonweed	Lambsquarter	Annual morning glory	Mustard	Pigweed	Smartweed	Sunflower	Velvetleaf	Bindweed, Field & Hedge	Hemp dogbane	Milkweed	Quackgrass	Wirestem muhly	Yellow nutsedge	Jerusalem artichoke
Treflan + Sencor/Lexone	G-F	E	E	E	E	E	G	F	G	G	E	P	E	E	E	G	E	P	P	P	P	P	P	F
Treflan	G-E	E	E	E	E	E	G	P	P	P	G	P	P	G	P	P	P	P	P	P	P	P	P	P
Cobex	F	E	E	E	E	G	G	P	P	P	G	P	P	G	F	P	F	P	P	P	P	P	P	P
Tolban	E	E	E	E	E	G	G	P	P	P	G	P	P	G	F	P	P	P	P	P	P	P	P	P
Vernam	G	E	E	E	E	G	G	P	P	P	G	F	F	G	P	P	G	P	P	P	P	P	G	P
Lasso	E	G-E	G-E	G-E	G-E	E	F	G	P	P	P	P	P	G	F	P	P	P	P	P	P	P	G	P
PREPLANT + OVERLAY																								
Treflan (PPI) + Amiben G	G	E	E	E	E	E	G	F	F	F	E	P	G	E	G	P	G	P	P	P	P	P	P	P
Treflan (PPI) + Lorox	G-F	E	E	E	E	E	G	F	F	G	E	P	G	E	G	F	G	P	P	P	P	P	P	P
Treflan (PPI) + Furloe	G	E	E	E	E	E	G	F	P	P	G	P	F	G	E	P	P	P	P	P	P	P	P	P
Treflan (PPI) + Sencor/Lexone	G-F	E	E	E	E	E	G	F	G	G	E	P	E	E	G	F	E	P	P	P	P	P	F	P
Treflan (PPI) + Modown	F	E	E	E	E	E	G	F	P	E	E	G	G	E	E	P	E	P	P	P	P	P	P	P
PREEMERGENCE																								
Amiben	G	E	G	G	G	F	P	G	F	F	E	P	G	E	G	F	G	P	P	P	P	P	P	P
Lasso	E	E	E	E	E	E	F	F	P	P	F	P	P	G	F	P	P	P	P	P	P	P	G	P
Lasso + Lorox	G-F	E	E	E	E	E	F	G	F	G	E	P	E	E	E	F	G	P	P	P	P	P	F	P
Lasso + Sencor/Lexone	G-F	E	E	E	E	E	F	G	G	G	E	P	E	E	E	F	G	P	P	P	P	P	F	P
Lasso + Maloran	G-F	E	E	E	E	E	F	G	F	G	E	P	G	E	E	F	G	P	P	P	P	P	F	P
Lasso + Furloe	E	E	E	E	E	E	F	F	P	P	G	P	F	G	E	P	P	P	P	P	P	P	F	P
Lasso + Dyanap	G-F	E	E	E	E	E	F	F	F	F	G	G	F	G	F	F	F	F	P	P	P	P	F	P
POSTEMERGENCE																								
Basagran	E	P	P	P	P	P	P	G	E	G	F	F	E	F	E	G	G	F	P	P	P	P	G	F
Tenoran	F	P	P	P	P	P	P	F	F-G	F	F	P	G	F	G	P	F	P	P	P	P	P	P	P
2,4-DB	P	P	P	P	P	P	P	F	E	G	P	G	P	P	P	P	P	F	P	P	P	P	P	P
Dyanap	P	P	P	P	P	P	P	P	G	F	F	F	F	F	F	F	P	P	P	P	P	P	P	P

This chart should be used only as a guide. Ratings of chemicals may be higher or lower than indicated depending on soil characteristics, managerial factors, environmental variables and rates applied.

Phototoxicity Symptoms of Misapplied Soybean Herbicides

Preplant:

Treflan + Sencor/Lexone	hypocotyl thickening and root inhibition and leaf chlorosis (yellowing)
Treflan	hypocotyl thickening and root inhibition
Cobex	hypocotyl thickening and root inhibition
Tolban	hypocotyl thickening and root inhibition (infrequently observed)
Vernam	leaf crinkling
Lasso	shortened midvein of leaf or leaflet

Preplant + Overlay:

Treflan (PPI) + Amiben G	hypocotyl thickening and root inhibition
Treflan (PPI) + Lorox	hypocotyl thickening and root inhibition and leaf chlorosis (yellowing)
Treflan (PPI) + Furloe	hypocotyl thickening and root inhibition
Treflan (PPI) + Sencor/Lexone	hypocotyl thickening and root inhibition and leaf chlorosis (yellowing)
Treflan (PPI) + Modown	hypocotyl thickening and root inhibition and leaf crinkling

Preemergence:

Amiben	root inhibition
Lasso	shortened midvein of leaf or leaflet
Lasso + Lorox	shortened midvein of leaf or leaflet and leaf chlorosis (yellowing)
Lasso + Sencor/Lexone	shortened midvein of leaf or leaflet and leaf chlorosis (yellowing)
Lasso + Maloran	shortened midvein of leaf or leaflet and leaf chlorosis (yellowing)
Lasso + Furloe	shortened midvein of leaf or leaflet
Lasso + Dyanap	shortened midvein of leaf or leaflet and stunted plants

Postemergence:

Basagran	leaf chlorosis (yellowing)
Tenoran	leaf crinkling and chlorosis
2,4-DB	plant deformation affecting leaves, stems and roots
Dyanap	leaf necrosis (browning)

WEED CONTROL IN GRASS PASTURES

Management and control of weeds in permanent pastures is not complete unless combined with a fertility program and controlled grazing. Fall or spring fertilization with nitrogen when temperatures are cool encourages tillering and thickening of permanent pasture grasses making it more difficult for many weed species to compete.

Timely application of herbicides along with a well planned fertility program will result in increased carrying capacity of the pasture. Spring spraying with 2,4-D is the most effective time to spray susceptible annual broadleaf weed species. Spray when most weeds have emerged and have fully expanded leaves. Warm temperatures (60 to 75 degrees F) will enhance the activity of 2,4-D.

Fall spraying with 2,4-D will be most effective in controlling susceptible winter annual, biennial and perennial broadleaf species that are in the rosette stage. Spraying will be successful well into October on many of these species. By spraying in the fall, the carbohydrate root reserve will be depleted and the overwintering weed will be less likely to survive.

Timely mowing will control many pasture weeds. Mowing is most effective in controlling weeds and buckbrush not affected by earlier spraying programs. Many midsummer weeds have hardened off and chemical control is less effective. Mowing at this time will control certain species and will also reduce weed seed production.

If a permanent pasture is very weedy and the stand of desirable perennial grasses is poor, reseeding may be the best alternative. For such pastures, a planned program of soil testing, fertilization, plowing (or other intensive tillage) followed by preparation of a firm seedbed before seeding is recommended. Then seeding to adapted legumes and grasses will usually eliminate most perennial pasture weed problems.

MAJOR WEEDS IN GRASS PASTURES

(see illustrations and information on following pages)

Common Name	Scientific Name	Other Common Names
Broadleaf Weeds		
Beggar tick	*Bidens frondosa*	Sticktight, devil's pitch fork
Bull thistle	*Cirsium vulgare*	
Canada thistle	*Cirsium arvense*	
Common mullein	*Verbascum thapsus*	
Common ragweed	*Ambrosia artemisiifolia*	Ragweed, small ragweed
Dandelion	*Taraxacum officinale*	
Dock (curled)	*Rumex crispis*	
Evening primrose	*Oenothera biennis*	
Giant ragweed	*Ambrosia trifida*	Horseweed
Horseweed	*Erigeron canadensis*	
Ironweed	*Veronia* spp.	Tall ironweed
Musk thistle	*Cardus nutans*	Nodding thistle
Plantain	*Plantago* spp.	Rugels and buckhorn spp.
Sheep sorrel	*Rumex acetosella*	
Sticktight	*Lappula echinata*	Stickseed
Tall thistle	*Cirsium altissimum*	Field thistle
Vervain	*Verbena* spp.	
White snakeroot	*Eupatorium rugosum*	
Whorled milkweed	*Asclepias verticillata*	
Wild carrot	*Daucus carota*	Queen Anne's lace
Yarrow	*Achillea millefolium*	
Grassy Weeds		
Downy bromegrass	*Bromus tectorum*	

Major Weeds in Grass Pastures

Broadleaf Weeds

BEGGAR TICK, Sticktight, Devil's pitchfork *(Bidens frondosa).* Entire plant. **Annual,** reproducing by seed.

BULL THISTLE, Spear thistle *(Cirsium vulgare).* Upper portion of stem. **Biennial,** reproducing by seed. In first year forms rosette with large fleshy taproot.

CANADA THISTLE, Creeping thistle *(Cirsium arvense).* Upper part of plant; new shoot; and root system. **Perennial,** reproducing by seeds and horizontal roots.

COMMON MULLEIN *(Verbascum thapsus).* Lower and upper portion of plant. **Biennial,** reproducing by seed.

COMMON RAGWEED *(Ambrosia artemisiifolia).* **1,** plant; **2,** seed.

DANDELION *(Taraxacum officinale).* Plant in flower. **Perennial,** reproducing by seed.

CURLED DOCK, Sour dock *(Rumex crispus).* Lower and upper part of plant. **Perennial,** with large, yellow, somewhat branched taproot, reproducing by seed.

EVENING PRIMROSE *(Oenothera biennis).* Upper portion of stem showing seed pods, flowers and buds. **Biennial,** reproducing by seeds.

GIANT RAGWEED, Horseweed, Kinghead *(Ambrosia trifida)*. **1**, portion of stem showing leaves and flowers: **2**, seed. **Annual, reproducing by seed.**

HORSEWEED, Marestail *(Erigeron canadensis)*. Lower part of leafy stem and upper part of stem with flowers. **Annual, reproducing by seed.**

TALL IRONWEED *(Vernonia altissima)*. Upper portion of stem. **Perennial**, reproducing by rhizomes and seed.

MUSK THISTLE, NODDING THISTLE *(Carduus nutans)*. Upper part of stem. **Biennial**, large, coarse plant.

BUCKHORN PLANTAIN, Ribgrass *(Plantago lanceolata)*. **1**, entire plant in bloom; **2**, two views of seed. **Perennial**, reproducing by seed.

RUGEL'S PLANTAIN, Black-seeded plantain *(Plantago rugelii)*. **1**, whole plant. **Perennial**, reproducing by seeds.

RED SORREL, Sheep sorrel *(Rumex acetosella)*. **1**, Young plant; **2**, entire plant. **Perennial**, reproducing by creeping rootstocks and seeds.

STICKTIGHT, Blue stickseed *(Lappula echinata)*. **1**, upper part of plant; **2**, young plant with roots. **Annual** or **winter annual**, reproducing by seeds.

TALL THISTLE, Roadside thistle *(Cirsium altissimum)*. Similar to Bull Thistle. **Biennial** and sometimes **perennial.**

BLUE VERVAIN *(Verbena hastata)*. **1,** upper part of stem. **Perennial,** reproducing by seed and short rhizomes.

HOARY VERVAIN *(Verbena stricta)*. **2,** upper part of stem in flower.

WHITE SNAKEROOT *(Eupatorium rugosum)*. **1,** upper part of the plant; **2,** root. **Perennial,** spreading by seeds and short rhizomes.

WHORLED MILKWEED *(Asclepias verticillata)*. **1,** base of plant with rootstock; **2,** shoot; **3,** upper portion of plant with flower clusters. **Perennial,** reproducing from seed and creeping rootstocks.

WILD CARROT, Queen Anne's lace *(Daucus carota).* Entire plant. **Biennial,** reproducing by seeds. In first year, produces rosette of finely divided leaves and fleshy taproot; in second year blooms and dies.

YARROW, Milfoil *(Achillea millefolium).* Plant in flower. **Perennial,** reproducing by seed and underground rootstocks.

GRASSY WEEDS

DOWNY BROMEGRASS, Downy chess *(Bromus tectorum).* Mature plant with fibrous root system. **Winter annual** or **annual** reproducing by seeds.

Grass Pasture Herbicides

Weeds most effectively controlled	Herbicide	Remarks	Limitations on crop use
SPRING—Most annual broadleaf weeds.	2,4-D	**SPRING**—Apply at least 1 qt of 4 lb a.e. amine or low volatile ester 2,4-D when most weeds are 4 to 6 inches tall and actively growing.	Do not graze dairy animals on treated areas within 7 days after application.
FALL—Many biennial and winter annual broadleaf weeds—thistles, etc.		**FALL**—Apply at least 1 qt of 4 lb a.e. amine, ester or low volatile ester 2,4-D when biennial and winter annual type weeds are in the rosette stage (mid-September to mid-October). Woody plants—Apply only in spring when plant leaves are fully expanded.	
Many woody species and hard-to-control perennial broadleaf weeds.	2,4,5-T or 2,4,5-TP (silvex)	Use in spring on woody plants with fully expanded leaves and as a supplement to 2,4-D	Do not graze dairy animals within 6 weeks or slaughter meat animals within 2 weeks of 2,4,5-T application.
Many woody and hard-to-control perennial broadleaf weeds.	Banvel (dicamba)	Use as directed under remarks for 2,4-D and 2,4,5-T. **Do not** apply if soybeans are growing nearby. Rates must be higher for many woody species. See the label.	Do not graze dairy animals for 7 to 21 days after application at these rates.

*Weed Response to Selected Grass Pasture Herbicides

E = Excellent G = Good F = Fair P = Poor

Weed	2,4-D, etc.	2,4,5-T	2,4,5-TP (silvex)	Banvel (dicamba)
Annuals:				
Horseweed or marestail	F	G	G	G
Ragweed	E	E	E	E
Stickseed or sticktight	G	—	—	—
Beggar ticks	E	E	—	—
Daisy fleabane	F	G	E	—
Pepper weed	E	E	G	—
Shepherd's purse	G	E	G	G
Biennials:				
Biennial thistles	E	E	E	E
Evening primrose	E	F	G	F
Mullein	P	F	—	—
Wild carrot	F	G	G	F
Perennials:				
Canada thistle	F	F	F	F
Dandelion	E	E	E	—
Ironweed	G	G	P	—
Sheep sorrel	None	None	P	—
Vervains	E	—	—	—
Whorled milkweed	None	P	F	P
Yarrow	P	P	P	P
Docks	G	G	G	—
Plantains	E	E	E	G

* This material is included for your information only; it is not required for certification.

WEED CONTROL IN SMALL GRAINS AND LEGUME FORAGES

Small Grains

Most weeds in oats and wheat are early maturing annuals or winter annuals whose life cycles are similar to that of the grain. In Iowa, most of them are broadleaved weeds, mustards being especially notorious. Important perennials include quackgrass and Canada thistle.

Weed control management in small grain involves seedbed preparation, clean and vigorously growing seed, and proper rotation to be effective.

Herbicides are supplements to sound crop production practices. Either 2,4-D or MCPA are useful postemergence, if a legume seeding is not present. If application is made properly, many common weeds will succumb and the operation is reasonably economical. Some crop injury is possible, especially from 2,4-D esters. In general, small grains are quite susceptible to injury from the boot stage until the seeds are well formed. Spraying through this period should be avoided. Crop seedling tolerance to MCPA tends to be greater than to 2,4-D, but MCPA kills fewer kinds of weeds. The 2,4-D esters are more effective weed killers than the amines but are more likely to cause crop seedling injury. Fall planted grains should not be treated with either 2,4-D or MCPA in the fall.

Dosages of 2,4-D in small grains only retard perennials such as bindweed and Canada thistle. In oats, little can be done about these weeds except removing by hand. Higher dosages of the phenoxy compounds will result in excessive crop injury unless application is made after the seeds are near physiological maturity. In well tillered wheat and barley, however, it is possible to use ½ qt per acre 2,4-D ester 4 a.e. without, in most instances, adverse effect on the grain.

Wild buckwheat and smartweed to a lesser extent are quite resistant to 2,4-D. If wild buckwheat is a major problem, the following may be useful: bromoxynil (Buctril, Brominal), early postemergence; Banvel (dicamba) or dicamba-MCPA mixtures, prior to the 5-leaf stage of grain.

In wheat and oats, early weed competition (probably through reducing tillering) is considerably more important in reducing yield than subsequent weed growth. Therefore, if a herbicide is to be used, it should be applied as soon as possible after the seedling-susceptible period of the crop has passed. Treatment after heading may aid in harvest, but will have little effect upon yield.

Since oats are often used as a nurse crop for 2,4-D sensitive legumes, the usefulness of this herbicide in oats is limited. The underseeding may be killed as well as the weeds. Alfalfa and sweet clover are especially sensitive, the clovers (Trifolium) less so. Herbicides probably should not be used unless the weed problem is serious. If applied, injury to the legumes may be minimized by reducing the dosage of 2,4-D amine (don't use the ester!) or MCPA by directing the spray up and permitting the grain to grow as tall as possible before treatment (6 to 12 inches, but before boot stage). Two,4-DB (Butoxone or Butyrac) can be employed; legumes are reasonably resistant to this herbicide. Small grain fields treated with 2,4-DB should not be grazed or cut for forage for a week following treatment. If 2,4-DB is used, grain or forage must not be harvested at least 30 days following treatment. Banvel (dicamba) treated fields must not be grazed or cut for forage.

Legume Forages

In forage production, weeds are harvested with the crop. Although the total quantity of forage produced on a given area may be similar with or without weeds, the quality of forage is greatly reduced if weeds are present. Weeds are usually lower in protein and digestibility and thus lower the feeding value of the harvested forage. The forage containing weeds also may be less palatable and consumption may be lowered. Thus controlling certain weeds may be advantageous in forage production.

The legume stand should always be considered before applying a chemical. A thin or irregular stand will not thicken up in open areas previously occupied by weeds once they are controlled. Annual weeds may then become a problem and the inevitable task of stand reestablishment is only prolonged.

Two chemicals may be useful in weed control or species management in legume forages. Princep is useful in established alfalfa stands to control seedling plants of yellow rocket, hoary alyssum, white cockle, wild mustard, downy brome, sheperd's purse and pennycress. Kerb is effective in established stands of alfalfa, clover, birdsfoot trefoil and crownvetch. It will kill or injure quackgrass and perennial grasses such as bromegrass, orchardgrass and timothy.

Always use good management practices in seedling establishment including proper fertilization and liming to encourage vigorous stands. If weeds are persistent, however, then consider herbicides to aid in controlling or managing common forage weeds.

Major Weeds in Small Grains and Legume Forage

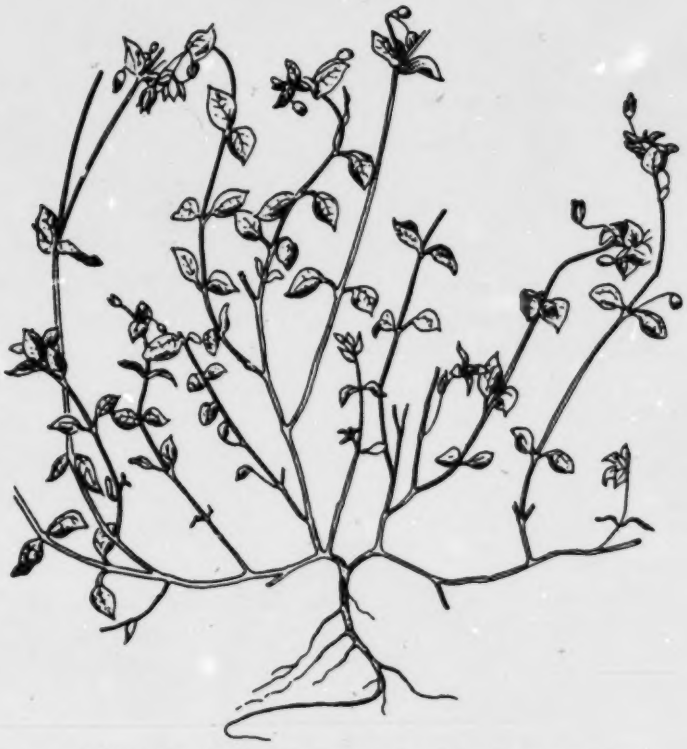
(see illustrations and information on following pages)

Common Name	Scientific Name	Other Common Names
Broadleaf Weeds		
Canada thistle	*Cirsium arvense*	
Common chickweed	*Stellaria media*	
Common milkweed	*Asclepias syriaca*	
Common ragweed	*Ambrosia artemisiifolia*	Ragweed, small ragweed
Field bindweed	*Convolvulus arvensis*	Creeping jenny, pea-vine
Hemp dogbane	*Apocynum cannabinum*	
Henbit	*Lamium amplexicaule*	
Hoary alyssum	*Berteroa incana*	Perennial peppergrass, white top
Lambsquarter	*Chenopodium album*	
Pennsylvania smartweed	*Polygonum pensylvanicum*	
Pennycress	*Thlaspi arvense*	Stinkweed, fanweed
Peppergrass	*Lepidium virginicum*	
Pigweed	*Amaranthus* spp.	
Tansy mustard	*Descurainia sophia*	
Russian thistle	*Salsola kali*	Common saltwort
White cockle	*Lychnis alba*	White champion
Wild buckwheat	*Polygonum convolulus*	Black bindweed
Wild mustard	*Brassica kaber*	Charlock
Yellow rocket	*Barbarea vulgaris*	Winter cress
Grassy Weeds		
Cheat	*Bromus secalinus*	Chess
Downy bromegrass	*Bromus tectorum*	Downy chess
Green foxtail	*Setaria viridis*	
Japanese chess	*Bromus japonicus*	
Quackgrass	*Agropyron repens*	
Wild oats	*Avena fatua*	
Yellow foxtail	*Setaria lutescens*	Pigeon grass

Major Weeds in Small Grains and Legume Forage

Broadleaf Weeds

CANADA THISTLE, Creeping thistle *(Cirsium arvense).* Upper part of plant; new shoot; and root system. **Perennial,** reproducing by seeds and horizontal roots.



COMMON CHICKWEED *(Stellaria media).* Plant in flower. **Winter annual** or **annual,** reproducing by seed and creeping stems, rooting at the nodes.

COMMON MILKWEED *(Asclepias syriaca).* **1,** lower part of stem and rootstock; **2,** upper part of stem with flower clusters and seed pods. **Perennial,** reproducing by seed and from long spreading rootstocks.

COMMON RAGWEED *(Ambrosia artemisiifolia).* **1,** plant; **2,** seed.

FIELD BINDWEED, Creeping Jenny, Small morning glory *(Convolvulus arvensis).* **1,** plant in flower; **2,** seed pod, entire and in cross section; **3,** seed; **4,** variations in leaf shape. **Perennial,** reproducing by seeds and rootstocks.

HEMP DOGBANE *(Apocynum cannabinum)* **1,** section of stems and rootstock; **2,** upper part of stem with leaves and flowers. **Perennial,** reproducing by seed and long, horizontal rootstocks.

HENBIT *(Lamium amplexicaule).* Entire plant. **Annual,** reproducing by seeds.

HOARY ALYSSUM *(Berteroa incana).* Upper part of flowering plant and lower part of plant. **Annual, biennial,** or **perennial,** reproducing by seeds.

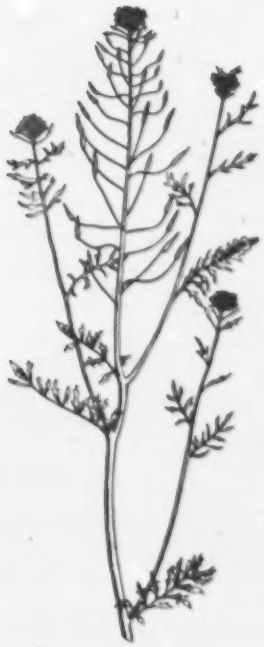
LAMBSQUARTER *(Chenopodium album)*. Roots, leaves and flowers. **Annual,** reproducing by seeds.

PENNSYLVANIA SMARTWEED *(Polygonum pensylvanicum)*. **1,** lower part of plant; **2,** upper part of plant. **Annual,** reproducing by seeds.

PENNYCRESS, Stinkweed, Fanweed *(Thlaspi arvense)*. Upper part of plant. **Annual** or **winter annual,** reproducing by seed.

PEPPERGRASS *(Lepidium virginicum)*. Top of plant. **Annual** or **winter annual,** reproducing by seed.

ROUGH PIGWEED, Redroot *(Amaranthus retroflexus)*. **1**, lower stem and roots; **2**, upper stem with leaves and flower clusters. **Annual**, reproducing by seeds.



TANSY MUSTARD, Flixweed *(Descurainia sophia)*. Upper portion of flowering plant. **Annual** or **biennial**, reproducing by seeds.

RUSSIAN THISTLE, Common saltwort *(Salsola kali)*. Branch and root. **Annual**, reproducing by seed.

WHITE COCKLE, White champion *(Lychnis alba)*. Entire plant. **Biennial**, or **short-lived perennial**. Reproduction largely by seeds.

WILD BUCKWHEAT, Black bindweed *(Polygonum convolvulus).* **1,** entire plant; **2,** mature seed; **3,** vine entwined around stem of grass. **Annual**, reproducing by seed.

WILD MUSTARD, Charlock *(Brassica kaber).* **1,** lower part of plant; **2,** upper part of plant. **Annual** or **winter annual,** reproducing by seeds.

YELLOW ROCKET, Winter cress *(Barbarea vulgaris).* **1,** upper part of plant; **2,** lower part of plant. **Winter annual, biennial,** or **perennial**, reproducing by seed, taprooted.

Grassy Weeds

CHEAT, Chess *(Bromus secalinus).* **2,** lower part of stem; **3,** panicle. **Winter annual** or **annual,** reproducing by seed.

DOWNY BROMEGRASS, Downy chess *(Bromus tectorum)*. Mature plant with fibrous root system. **Winter annual** or **annual** reproducing by seeds.

GREEN FOXTAIL, Green bristlegrass *(Setaria viridis)*. Entire plant. **Annual**, similar to giant foxtail but smaller, growing 1 to 3 feet tall.

JAPANESE CHESS *(Bromus japonicus)*. **1**, part of hairy stem. **2**, Winter annual or **annual**, reproducing by seeds.

QUACKGRASS, Couchgrass *(Agropyron repens)*. Stems, leaves, and inflorescence. **Perennial**, reproducing by seed and underground rootstocks.

WILD OATS *(Avena fatua).* Panicle. **Annual,** reproducing by seed.

YELLOW FOXTAIL, Pigeon grass *(Setaria lutescens).* Entire plant. **Annual,** reproducing by seeds.

Small Grain Herbicides

Weeds most effectively controlled	Herbicide	Remarks	Limitations on crop use
Oats or Wheat			
Many annual broadleaf weeds.	2,4-D (amine)	Use from six-leaf stage to early boot. May damage underseeded legume.	**Do not** forage or graze for 2 weeks after treatment.
Many annual broadleaf weeds.	MCPA (amine)	Use from two-leaf stage to early boot. More expensive than 2,4-D.	None.
Wild buckwheat and smartweed.	Buctril or Brominal (bromoxynil)	Use from two-leaf stage to early boot.	None.
Many annual broadleaf weeds plus wild buckwheat and smartweed.	Banvel (dicamba)	Use from two- to five-leaf stage.	**Do not** graze or feed threshings to livestock.
Wheat Only			
Many annual broadleaf weeds.	2,4-D (ester)	Use from five-leaf stage to early boot. May be more injurious than amine formulation to crop and underseeded legume.	Do not forage or graze for 2 weeks after treatment.

Legume Forage Herbicides

Alfalfa, Clover, Birdsfoot Trefoil, or Crownvetch			
Quackgrass and other perennial grasses	Kerb (pronamide) 50W	Apply in late fall (after Oct. 15) when soil temperatures are less than 60° F. Increases quality, but not quantity of forage.	**Do not** graze or harvest within 120 days of application.
Alfalfa Only			
Yellow rocket White cockle Hoary alyssum Wild mustard Downy brome Shepherd's purse Pennycress	Princep (simazine) 80W	Apply in the fall on alfalfa stands established more than 1 year.	Do not feed treated forage for 30 days or harvest hay for 60 days after treatment.

SPECIAL THINGS TO CONSIDER WHEN APPLYING CROP HERBICIDES

Preharvest and Re-entry Intervals

Many pesticides are restricted by a minimum time from last application to harvest. This time requirement is known as the preharvest interval. The label and extension pest control publications furnish needed information on this restriction. Preharvest intervals should be carefully observed to prevent harvesting an illegally contaminated product.

The minimum time between applying a chemical and workers entering the treated area is known as the re-entry interval. This restriction is presently required for only some pesticides that are highly toxic to warm-blooded animals. Re-entry intervals should be carefully observed.

Phytotoxicity

When a chemical burns a plant to which it is applied, it is said to be phytotoxic (plant toxic). If the plant is a weed and the chemical a herbicide, the result is good, but usually the word phytotoxic is used when a pesticide adversely affects plants. Phytotoxicity may occur due to drift onto nontarget plants, excessive rates, mixing of chemicals that are not toxic when used alone, and using chemicals in a more concentrated form than is desirable. Certain weather patterns may cause or increase the amount of phytotoxicity. Exceptionally bright, hot, dry weather following a period of cooler weather is such a situation. It is not unusual to get some phytotoxicity when using pesticides in accordance with recommended practices. It is unusual to have a severe phytotoxicity problem under these circumstances.

To avoid phytotoxicity, apply chemicals within recommended rates. Do not mix chemicals unless the label indicates it is all right. Time applications according to recommendations. Use recommended water rates.

Residues

The amount of a pesticide that remains after application is the residue. The ideal pesticide would be one that is residual enough to give control of a pest for the length of time needed and then breaks down into completely harmless chemicals. Unfortunately, this is not the case with most pesticides. The long residual nature of chlorinated hydrocarbons is one of the main reasons they are being used less. Usually a tolerance is set for each chemical that is registered on a crop. It is expressed in parts per million (ppm). The residue that remains on the harvested crop cannot exceed the tolerance that was set when the pesticide was labeled. This has a direct relationship to the preharvest intervals. Registered and recommended rates should not be exceeded because the residue may exceed the legal tolerance.

The residue of pesticides in soils may create problems. If a chemical is legally used on one crop, and it is not legal on the succeeding crop, an illegal residue may result. See the section on contamination of soil and water for additional information.

Environmental Contamination

Nontarget Injury and Community Problems: Care should be exercised not to contaminate nontarget areas when applying a pesticide. This is particularly true of food and feed crops, bodies of water, apiaries, woodlands, and urban areas. Information on the least hazardous recommended chemical to use where there is danger of contamination, can be obtained from county extension offices.

Drift is probably the chief culprit contributing to contamination of nontarget areas. Pesticides should be applied when there is little or no wind. Some pesticides, particularly herbicides, may badly damage or completely destroy some crops if they are allowed to drift onto them. The phenoxy herbicides (2,4-D, 2,4,5-T, etc.) are examples of the type of chemicals that can be very damaging (see following section, Controlling Herbicide Drift).

Contamination of Soil and Water: When pesticides are being used, care should be taken to prevent undue contamination of the soil and bodies of water. Select the pesticide least likely to cause contamination problems.

For example, carefully mark each swath in order to avoid a double application. Some herbicides and long residual insecticides may have a carryover effect if excessive rates are used. This could contaminate or destroy subsequent crops.

When bodies of water are close to the area being treated, select the recommended chemical that would be least likely to contaminate the water. Apply the chemical when there is no wind or when the wind is in the direction to drift the chemical away from the water. Do not apply the chemical when heavy washing rain is probable.

CONTROLLING HERBICIDE DRIFT

The term "drift" refers to the movement of herbicides through the air to areas not intended for treatment from areas of intended treatment. It presents a potential hazard to sensitive vegetation (crops, gardens, ornamentals), wildlife, people, livestock and aquatic areas adjacent to rights-of-way.

Types of Drift

(1) Particle drift—At the time of application, small spray droplets can be carried by air movement from the application area to other areas.

To reduce the danger of particle drift damage:

- —use nozzles that apply a coarse spray;
- —use low pressures;
- —avoid spraying on windy days when drift could occur;
- —spray when air movement is away from susceptible crops or ornamentals;
- —if drift is a hazard and spraying is necessary, use special drift control agents or formulations in properly designed and adjusted equipment.

Particles of fog or mist size present the greatest drift hazard. These size particles are often generated by high volume spraying equipment using high pressures for foliage treatment of trees and brush.

(2) Vaporization—This results from the tendency of chemicals to vaporize or give off fumes. The movement of such fumes with wind currents may injure sensitive vegetation a mile or more from the point of application.

Ester formulations of the phenoxy-type herbicides (2,4-D, 2,4,5-T, 2,4,5-TP, etc.) present the greatest potential for vaporization. Amine formulations of these herbicides are essentially nonvolatile and do not present a vapor drift hazard.

Drift Control Agents[1]: Adjuvants and application systems have been developed which help overcome certain inherent drift problems that exist in conventional spraying.

Three of these systems are

(1) foams,

(2) invert emulsions, and

(3) spray additive stabilizers.

Though different in method, all three systems offer better drift control and more highly visible spray (better placement).

[1] *This section adapted from E. I. DuPont DeNemours & Co., Inc. Manual A-86439 "Weed and Brush Control-Technical Manual for Professionals" pp. 6-7.*

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